**APPENDIX A**

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME
Wildlife and Habitat Data Analysis Branch
California Natural Diversity Database
**SPECIAL ANIMALS (673 taxa) (Excerpts)**
August 2004

## CALIFORNIA ENDANGERED SPECIES ACT (CESA) LISTING CODES:

The listing status of each species is current as of the date of this list. The most current changes in listing status will be found in the list of "Endangered and Threatened Animals of California", which the CNDDB updates and issues quarterly (January, April, July, & October).

SE State-listed as Endangered
ST State-listed as Threatened
SCE State candidate for listing as Endangered
SCT State candidate for listing as Threatened

## ENDANGERED SPECIES ACT (ESA) LISTING CODES:

The listing status is current as of the date of this list. The most current changes in listing status will be found in the list of "Endangered and Threatened Animals of California", which the CNDDB updates and issues quarterly (January, April, July, & October). Federal listing actions are also available at: http://www.epa.gov/fedrgstr/EPA-SPECIES/index.html.
After careful consideration we have removed the Federal Species of Concern (FSC) designation from this list. The Federal Species of Concern list was not maintained on a statewide basis. The Sacramento field office, with jurisdiction over the central portion of California, maintained a list, but the Ventura, Carlsbad and Arcata offices did not. Therefore, species in the northern and southern parts of the state were not considered. Information on the list maintained by the Sacramento field office is available at: http://sacramento.fws.gov/es/spp_concern.htm

FE Federally listed as Endangered
FT Federally listed as Threatened
FPE Federally proposed for listing as Endangered
FPT Federally proposed for listing as Threatened
FPD Federally proposed for delisting
FC Federal candidate species (former Category 1 candidates)

**DFG: CSC:** California Special Concern species. It is the goal and responsibility of the Department of Fish and Game to maintain viable populations of all native species. To this end, the Department has designated certain vertebrate species as "Species of Special Concern" because declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction. The goal of designating species as "Species of Special Concern" is to halt or reverse their decline by calling attention to their plight and addressing the issues of concern early enough to secure their long term viability. Not all "Species of Special Concern" have declined equally; some species may be just starting to decline, while others may have already reached the point where they meet the criteria for listing as a "Threatened" or "Endangered" species under the State and/or Federal Endangered Species Acts. More information is available on the Department's web site at: http://www.dfg.ca.gov/hcpb/species/ssc/ssc.shtml. All of the Species of Special Concern reports are now available on-line:

Birds: http://www.dfg.ca.gov/hcpb/info/bird_ssc.shtml.
Mammals: http://www.dfg.ca.gov/hcpb/info/mammal_ssc.shtml.
Fish: http://www.dfg.ca.gov/hcpb/info/fish_ssc.pdf.
Amphibians & Reptiles: http://www.dfg.ca.gov/hcpb/info/herp_ssc.pdf.

**DFG: Fully Protected:** Fully Protected species may not be taken or possessed without a permit from the Fish and Game Commission. Information of Fully Protected species can be found in the Fish and Game Code, (birds at §3511, mammals at §4700, reptiles and amphibians at §5050, and fish at §5515). Additional information on Fully Protected fish can be found in the California Code of Regulations, Title 14, Division 1, Subdivision 1, Chapter 2, Article 4, §5.93. The category of Protected Amphibians and Reptiles in Title 14 has been repealed. The Fish and Game Code is available online at: http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=fgc. Title 14 of the California Code of Regulations is available at: http://ccr.oal.ca.gov.

| | CNDDB RANK | CESA | ESA | IUCN | OTHER |
|---|---|---|---|---|---|

## MAMMALS (120 taxa)

**TALPIDAE** (moles)

| | | | | | |
|---|---|---|---|---|---|
| *Scapanus latimanus parvus*<br>Alameda Island mole | G5T1S1 | | | | DFG: CSC |
| +*Scapanus latimanus insularis*<br>Angel Island mole | G5T1S1 | | | | |

**SORICIDAE** (shrews)

| | | | | | |
|---|---|---|---|---|---|
| *Sorex lyelli*<br>Mount Lyell shrew | G2G3S2S3 | | | | DFG: CSC |
| +*Sorex ornatus relictus*<br>Buena Vista Lake shrew | G5T1S1 | | FE | | DFG: CSC |
| *Sorex ornatus salarius*<br>Monterey shrew (AKA Salinas ornate shrew) | G5T1T2S1S2 | | | | DFG: CSC |
| *Sorex ornatus salicornicus*<br>Southern California saltmarsh shrew | G5T1?S1? | | | | DFG: CSC |
| +*Sorex ornatus sinuosus*<br>Suisun shrew | G5T1S1 | | | | DFG: CSC |
| +*Sorex ornatus willetti*<br>Santa Catalina shrew | G5T1S1 | | | | DFG: CSC |
| +*Sorex vagrans halicoetes*<br>Salt-marsh wandering shrew | G5T1S1 | | | | DFG: CSC |
| *Sorex vagrans paludivagus*<br>No common name | G5T1S1 | | | | |

**PHYLLOSTOMIDAE** (leaf-nosed bats)

| | | | | | |
|---|---|---|---|---|---|
| +*Choeronycteris mexicana*<br>Mexican long-tongued bat | G4S1 | | | LRnt | DFG: CSC<br>WBWG: High priority |
| +*Macrotus californicus*<br>California leaf-nosed bat | G4S2S3 | | | VU/A2c | DFG: CSC<br>FS: Sensitive<br>WBWG: High priority |

**VESPERTILIONIDAE** (evening bats)

| | | | | | |
|---|---|---|---|---|---|
| +*Antrozous pallidus*<br>Pallid bat | G5S3 | | | | DFG: CSC<br>FS: Sensitive<br>BLM: Sensitive<br>WBWG: High priority |
| +*Corynorhinus townsendii pallescens*<br>Pale big-eared bat | G4T4S2S3 | | | VU/A2c<br>(full species) | DFG: CSC<br>(full species)<br>FS: Sensitive<br>(full species)<br>BLM: Sensitive<br>(full species)<br>WBWG: High Priority |

| | CNDDB RANK | CESA | ESA | IUCN | OTHER |
|---|---|---|---|---|---|
| +*Corynorhinus townsendii townsendii*<br>Townsend's western big-eared bat | G4T3T4S2S3 | | | VU/A2c<br>(Full species) | DFG: CSC<br>(full species)<br>FS: Sensitive<br>(full species)<br>BLM: Sensitive<br>(full species)<br>WBWG: High Priority |
| +*Euderma maculatum*<br>Spotted bat | G4S2S3 | | | | DFG: CSC<br>BLM: Sensitive<br>WBWG: High priority |
| +*Lasiurus blossevillii*<br>Western red bat | G5S? | | | | WBWG: High priority<br>FS: Sensitive |
| *Lassiurus xanthinus*<br>Western yellow bat | G5S? | | | | WBWG: High priority |
| +*Myotis ciliolabrum*<br>Small-footed myotis | G5S? | | | | BLM: Sensitive |
| +*Myotis evotis*<br>Long-eared myotis | G5S4? | | | | BLM: Sensitive |
| *Myotis occultus (=Myotis lucifugus occultus)*<br>Occult little brown bat (AKA Arizona myotis) | G5T3T4S2S3 | | | | DFG: CSC |
| +*Myotis thysanodes*<br>Fringed myotis | G4G5S4 | | | | BLM: Sensitive<br>WBWG: High priority |
| +*Myotis velifer*<br>Cave myotis | G5S1 | | | | DFG: CSC<br>BLM: Sensitive |
| +*Myotis volans*<br>Long-legged myotis | G5S4? | | | | WBWG: High priority |
| +*Myotis yumanensis*<br>Yuma myotis | G5S4? | | | | BLM: Sensitive |
| **MOLOSSIDAE** (free-tailed bats) | | | | | |
| +*Eumops perotis*<br>Western mastiff bat | G5S3? | | | | DFG: CSC<br>BLM: Sensitive<br>WBWG: High priority |
| +*Nyctinomops femorosaccus*<br>Pocketed free-tailed bat | G4S2S3 | | | | DFG: CSC |
| *Nyctinomops macrotis*<br>Big free-tailed bat | G5S2 | | | | DFG: CSC |
| **OCHOTONIDAE** (pikas) | | | | | |
| *Ochotona princeps sheltoni*<br>White Mountains pika | G5T1T2S1S2 | | | | |
| **LEPORIDAE** (rabbits and hares) | | | | | |
| +*Brachylagus idahoensis*<br>Pygmy rabbit | G4S3 | | | LRnt | DFG: CSC |
| *Lepus americanus klamathensis*<br>Oregon snowshoe hare | G5T3T4S2? | | | | DFG: CSC |

| | CNDDB RANK | CESA | ESA | IUCN | OTHER |
|---|---|---|---|---|---|
| **CANIDAE** (foxes, wolves, and coyotes) | | | | | |
| +*Urocyon littoralis* Island fox | G1S1 | ST[31] | | LRcd | |
| +*Urocyon littoralis littoralis* San Miguel Island fox | G1T1S1 | | FE | | |
| +*Urocyon littoralis santarosa* Santa Rosa Island fox | G1T1S1 | | FE | | |
| +*Urocyon littoralis santacruzae* Santa Cruz Island fox | G1T1S1 | | FE | | |
| +*Urocyon littoralis catalinae* Santa Catalina Island fox | G1T1S1 | | FE | | |
| +*Vulpes macrotis mutica* San Joaquin kit fox | G4T2T3S2S3 | ST | FE | | |
| +*Vulpes vulpes necator* Sierra Nevada red fox | G5T3S1 | ST | | | FS: Sensitive |
| **MUSTELIDAE** (weasels and relatives) | | | | | |
| +*Enhydra lutris nereis* Southern sea otter | G4T2S2 | | FT | EN/A1ace (full species) | DFG: Fully protected |
| +*Gulo gulo* California wolverine | G4S2 | ST | | VU/A2c | DFG: Fully protected<br>FS: Sensitive (ssp. *Luteus*) |
| *Lontra canadensis sonorae* Southwestern river otter | G5T1S1 | | | | DFG: CSC<br>BLM: Sensitive |
| +*Martes americana* American (=pine) marten | G5S3S4 | | | | FS: Sensitive |
| +*Martes americana humboldtensis* Humboldt marten | G5T2T3S2S3 | | | | DFG: CSC<br>FS: Sensitive (full species) |
| +*Martes pennanti pacifica* Pacific fisher | G5T3T4QS2S3 | | FC[32] | | DFG: CSC (full species)<br>FS: Sensitive<br>BLM: Sensitive |
| +*Taxidea taxus* American badger | G5S4 | | | | DFG: CSC |
| **MEPHITIDAE** (skunks) | | | | | |
| *Spilogale gracilis amphiala* Channel Islands spotted skunk | G5T3S3 | | | | DFG: CSC |
| **FELIDAE** (cats and relatives) | | | | | |
| *Puma concolor browni* Yuma mountain lion | G5T1T2QS1 | | | | DFG: CSC |

[31] State listing includes all subspecies on all islands.
[32] Candidate status refers to the distict population segment in Washington, Oregon and California.

# APPENDIX B

**Common Gray Fox Urocyon cinereoargenteus**
**Family: Canidae Order: Carnivora Class: Mammalia**
**Written by: G. Ahlborn**
**Reviewed by: M. White**
**Edited by: M. White**

## DISTRIBUTION, ABUNDANCE, AND SEASONALITY

Uncommon to common permanent resident of low to middle elevations throughout most of the state. Frequents most shrublands, valley foothill riparian, montane riparian, and brush stages of many deciduous and conifer forest and woodland habitats. Also found in meadows and cropland areas.

## SPECIFIC HABITAT REQUIREMENTS

Feeding: Omnivorous. Rabbits, mice, gophers, woodrats, and squirrels are the principal foods (Trapp and Hallberg 1975). Also eats large amounts of fruits, nuts, grains, grasshoppers and crickets, beetles, moths and butterflies, carrion, and small amounts of herbage. Stalks and pounces on rodents and rabbits, or may pursue for short distances. Readily climbs into crooked trees, or those with branches 3 m (10 ft), or less, from the ground (Ingles 1965).

Cover: Brush, natural cavities, and occasionally human-made structures, provide cover.

Reproduction: Dens in natural cavities, in rocky areas, snags, logs, brush, slash and debris piles, abandoned burrows, and under buildings. Nest material usually dry grass, leaves, or shredded bark.

Water: Requires a permanent water source near den; probably drinks daily.

Pattern: Suitable habitat consists of shrublands, brushy and open-canopied forests, interspersed with riparian areas, providing water.

## SPECIES LIFE HISTORY

Activity Patterns: Active all year. Primarily crepuscular and nocturnal, occasionally active in daytime.

Seasonal Movements/Migration: Non-migratory.

Home Range: In Wisconsin, home ranges varied from 0.13 to 3.1 $km^2$ (0.05 to 1.2 $mi^2$). In Florida, home ranges averaged 7.7 $km^2$ (8 $mi^2$), and in Utah, home ranges averaged 1.0 $km^2$ (0.4 $mi^2$) (Trapp and Hallberg 1975). Near Davis, California, Fuller (1978) found that 4 females had an average home range of 1.2 $km^2$ (0.5 $mi^2$).

Territory: Family groups (parents with juveniles) usually are separated spatially, indicating territoriality (Trapp and Hallberg 1975).

Reproduction: Mates February through March. In California, most births occur in April (Grinnell et al. 1937), following a gestation of approximately 63 days. Average litter size is 4 pups; range 2-7 (Fritzell and Haroldson 1982). One litter/yr. Males and females are sexually mature at 1 yr.

Niche: Adult gray foxes have few predators. Large hawks, golden eagles, great horned owls, domestic dogs, and bobcats may prey on pups. May carry tularemia and rabies (Jennings et al. 1960, Jackson 1961). Population levels may be affected by rabies.

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# APPENDIX C

**Kit Fox Vulpes macrotis**
**Family: Canidae Order: Carnivora Class: Mammalia**
**Written by: G. Ahlborn**
**Reviewed by: M. White**
**Edited by: M. White, G. Ahlborn**
**Updated by: CWHR Program Staff, May 2000**

## DISTRIBUTION, ABUNDANCE, AND SEASONALITY

Uncommon to rare, permanent resident of arid regions of the southern half of the state (Grinnell et al. 1937, Wilson and Ruff 1999:150). May still occur in eastern Lassen County. Lives in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub. The San Joaquin kit fox (V. m. mutica) is Federal Endangered and California Threatened.

## SPECIFIC HABITAT REQUIREMENTS

Feeding: Kit foxes primarily are carnivorous. The principal foods are black-tailed jackrabbits and desert cottontails, rodents (especially kangaroo rats and ground squirrels), insects, reptiles, and some birds, bird eggs, and vegetation (Egoscue 1962, Laughrin 1970, Morrell 1971, 1972, Orloff et al. 1986). They hunt by searching, meandering, circling clumps of brush, and wandering back and forth between clumps of vegetation. They stealthily approach larger prey, or prey in the open, then make sudden, swift rushes. They pounce on smaller prey.

Cover: Cover provided by dens they dig in open, level areas with loose-textured, sandy and loamy soils (Laughrin 1970, Morrell 1972).

Reproduction: Pups born in dens excavated in open, level areas with loose-textured soils.

Water: May not require a source of drinking water. Sustains itself on moisture derived from prey (Thacker and Flinders 1999).

Pattern: Open, level areas with loose-textured soils supporting scattered, shrubby vegetation with little human disturbance represent suitable habitats for kit foxes. Some agricultural areas may support these foxes.

## SPECIES LIFE HISTORY

Activity Patterns: Active yearlong; mostly nocturnal, but often active in daytime in cool weather (Ingles 1965).

Seasonal Movements/Migration: Non-migratory.

Home Range: Little data available. In California, Morrell (1972) reported home ranges of 2.6-5.2 km² (1.0-2.0 mi²) for the San Joaquin kit fox. Considerable overlap between individual home ranges appears to occur (Morrell 1972). In Utah, Egoscue (1962) reported 0.19 kit foxes/km² (0.5/mi²) before birth of pups, and 0.48 per km² (1.25/mi²) after pups were born.

Territory: No data found.

Reproduction: Kit foxes usually are monogamous, but polygamy apparently also is common (McGrew 1979). Most pups born February through April, following a gestation period of 49 to 55 days (Egoscue 1962). One litter/yr of about 4 pups, range 1-7 (McGrew 1979). Pups weaned at about 4-5 mo. Males and females sexually mature in second yr. In Utah, Egoscue (1975) found a known-age individual of 7 yr at last capture.

Niche: Kit foxes play important roles in their respective ecosystems as "architects of subterranean burrows", which in turn provide cover for many other species (Thacker and Flinders 1999). Kit foxes use dens throughout the year. Nocturnal activity and regular use of dens are important adaptations for thermal regulation and water conservation (Golightly 1981). Potential predators are coyotes, large hawks and owls, eagles, and bobcats. Cultivation has eliminated much habitat. Kit foxes are vulnerable to many human activities, such as hunting, use of rodenticides and other poisons, off-road vehicles, and trapping.

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## APPENDIX D

**Red Fox Vulpes vulpes**
**Family: Canidae Order: Carnivora Class: Mammalia**
**Written by: V. Johnson, J. Harris**
**Reviewed by: H. Shellhammer**
**Edited by: R. Duke, S. Granholm**
**Updated by: CWHR Program Staff, May 2000**

### DISTRIBUTION, ABUNDANCE, AND SEASONALITY

Rare in Sierra Nevada, but widely distributed in lowlands in central and southern California. The native subspecies V. v. necator is found in the Cascades in Siskiyou Co., and from Lassen Co. south to Tulare Co. Introduced populations inhabit Sacramento and San Joaquin valleys and scattered coastal and inland locations from Sonoma Co. south to Monterey Co., and east to Stanislaus Co. as well as in Ventura, Los Angeles, and Orange cos. Sierra Nevada populations may be found in a variety of habitats, including alpine dwarf-shrub, wet meadow, subalpine conifer, lodgepole pine, red fir, aspen, montane chaparral, montane riparian, mixed conifer, and ponderosa pine. Jeffrey pine, eastside pine, and montane hardwood-conifer also are used. Populations in central and southern California occur in annual and perennial grassland, coastal scrub, wet meadow, emergent wetland, and cropland habitats, and may use mixed chaparral and chamise-redshank chaparral (Grinnell et al. 1937, Ingles 1965, Ewer 1973, Ables 1975, Gray 1975, 1977, Schempf and White 1977, Gould 1980). Most sightings in Sierra Nevada are above 2200 m (7000 ft), ranging from 1200-3700 m (3900-11,900 ft) (Schempf and White 1977). Sightings in central and southern California are below 910 m (3000 ft) (Schempf and White 1977).

### SPECIFIC HABITAT REQUIREMENTS

Feeding: Hunts small and medium-sized mammals, ground squirrels, gophers, mice, marmots, woodrats, pikas, and rabbits. Apparently an increasingly important predator of ground-nesting waterfowl, shorebirds, upland game birds, and eggs in lowland California and other areas. Other vertebrates, insects, carrion, fruits, and earthworms used occasionally; carrion important in winter, as are lagomorphs. Hunts in meadows, fell-fields, grasslands, wetlands, and other open habitats. Caches food (Scott 1955, Scott and Klimstra 1955, Sargent 1972, 1978, Ewer 1973, MacDonald 1980, Maccarone and Montevecchi 1981,Samuel and Nelson 1982, Yoneda 1982).

Cover: Uses dense vegetation and rocky areas for cover and den sites.

Reproduction: Den sites include rock outcrops, hollow logs and stumps, and burrows in deep, loose soil (Grinnell et al. 1937, Ables 1975). May move pups to new den several times.

Water: Captive red foxes did not require free water as pups or adults (Sargent 1978).

Pattern: In Sierra Nevada, prefers forests interspersed with meadows or alpine fell-fields. Open areas are used for hunting, forested habitats for cover and reproduction. Edges are utilized extensively (Seidensticker 1999). In lowlands, uses fence lines, hedgerows, woodlots, and other brushy, wooded areas for cover and reproduction, and hunts in cropland, wetland, urban habitats and other open areas (Grinnell et al. 1937. Ables 1975, Samuel and Nelson 1982).

**SPECIES LIFE HISTORY**

Activity Patterns: Active yearlong; hunts day and night (Grinnell et al. 1937, Ables 1975).

Seasonal Movements/Migration: None in many habitats. Sierra red foxes move downslope in winter into ponderosa pine and mixed conifer, upslope in summer to lodgepole pine, subalpine conifer, alpine dwarf-shrub, and red fir habitats (Grinnell et al. 1937, Schempf and White 1977).

Home Range: Summer home ranges in alpine and subalpine tundra of British Columbia averaged 1611 ha (3979 ac), varying from 277-3420 ha (684-8447 ac) (Jones and Theberge1982). In Minnesota, lllinois, and Wisconsin, home ranges averaged 700 ha (1728 ac) and varied from 155-1554 ha (384-3840 ac) (Sargent 1972, Storm et al. 1976). Red foxes have been known to travel up to 395 km (245 mi). Home range size is influenced by food abundance and habitat.

Territory: The male defends the territory, which is shared by the mated pair and pups. Defense consists of display, scent-marking, chasing, and rare physical conflict (Preston 1975). The entire home range may be defended, or territoriality may break down in times of food abundance (Orr 1971, Zarnoch et al. 1977, Samuel and Nelson 1982, Seidensticker 1999).

Reproduction: Mating takes place in late winter (January-March. After a gestation period of 52 days, young are born in early spring (March-May). Litter sizes in many studies averaged about 5. Most litters are 4-6, though range is 1-12 (Grinnell et al. 1937, Samuel and Nelson 1982). There is 1 litter/yr. Lactation continues 56-70 days (Seidensticker 1999). Pups dependent on parents for 6 mo, and become sexually mature at 10 mo (Orr 1971, Zarnoch et al. 1977).

Niche: Coexists with coyotes in Sierra Nevada, and with gray and kit foxes and coyotes in lowland California. Numbers apparently increase when numbers of coyotes and other predators decrease, through predator control or natural factors (Schmidt 1986). Sierra Nevada populations apparently reduced by grazing in meadows, which reduces prey populations, and by trapping, logging, and recreational disturbance (Grinnell et al. 1937, Schempf and White 1977).

Comments: Sierra Nevada red foxes are rare, and numbers may be continuing to decline (Schempf and White 1977). Lowland populations, presumably introduced, are expanding in range and numbers (Gray 1977, Gould 1980).

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## APPENDIX E

BATS IN BUILDINGS

### Guidelines for Excluding Bats

Our goal is to promote exclusion methods that ensure the safety of both bats and people. We understand that differing architectural structures and/or climatic conditions may require modification of the guidelines given below. Please feel free to share your ideas about these issues with us when submitting your letter of commitment. We want to encourage you to participate in the "Bats In Buildings" program and look forward to receiving your input.

All BCI recommended exclusion professionals should be licensed by the states in which they work, be insured, and use only approved exclusion methods. They should also provide the property owner with a guarantee and list of references. All written materials should be accurate and scare tactics should be avoided.

One-way devices constructed from light weight polypropylene netting (<1/6" mesh), plastic sheeting, or tube-type excluders are the preferred methods for evicting bats from buildings. Excluders should be placed at all active entry points and should remain in place for at least 5 to 7 days. These devices should be removed after the bats have been excluded, and then exclusion points should be sealed with silicone caulking, caulk backing rod, hardware cloth, or heavy duty polypropylene mesh. In some cases, sealing may require repair or replacement of old, deteriorated wood. BCI strongly recommends that exclusion professionals bat-proof the entire building and avoid spot treatments. Moving bats from one corner of a building to another does not solve the problem and may require that further exclusion work is carried out at some time in the future, further disturbing the bats and the property owner.

Please note that simply waiting until the bats have flown out at night and then permanently sealing entrances shut without the use of exclusion devices, is not approved by BCI. This method often traps some bats inside the building. BCI also discourages the use of 'permanent netting' in most situations. Aerosol dog and cat repellents may discourage bat use of a particular roosting spot for periods of up to several months. They have been used effectively to prevent bats from night-roosting above porches. The spray should be applied by day when bats are not present. Aerosol repellents are not an adequate substitute for exclusion in the case of day roosts and should never be applied when bats are in a roost. For night roosts, we also recommend the use of Mylar balloons or strips of tin foil hung from roosting areas and allowed to move in the breeze.

Maternity season for bats in the US and Canada can range from 1 May through 31 August, although pups have been seen as early as late April in some instances. Eviction of bats, or any activity that directly affects their roosting area, should occur only prior to or after the maternity season, when young will not be trapped inside, creating additional problems.

Some bats hibernate in buildings during the winter months. Winter exclusions should be performed only if it can be determined that no bats are hibernating in the building. If bats are present during the winter months, exclusions should be postponed until spring temperatures are warm enough for deciduous plants to leaf out and insects to again be abundant.

Ultrasonic devices, chemical repellents, and smoke are not approved by BCI as effective methods to evict bats from buildings. In addition, canned spray foam is not an approved sealant for cracks and holes in most situations. It is not only unattractive, but can result in the death of bats that come into contact with it. This product should never be used when bats are still present.

Traps and relocation are not BCI approved exclusion techniques. Removing large numbers of bats from a building may seem impressive to a customer, but is unlikely to be effective. Traps can be fatal to bats if left unattended or if overcrowding occurs. Bats have excellent homing instincts making relocation attempts unlikely to succeed. They will simply attempt to return to the original capture area upon release. Capturing bats at an exclusion site is not encouraged, although capturing a single bat for species ID or removal of an individual bat from a living space are exceptions to this rule.

Cited from: http://www.batcon.org/binb/guidelines.html



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**APPENDIX F**

# UNWANTED GUESTS: EVICTING BATS FROM HUMAN DWELLINGS

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ABSTRACT: Bats are the second largest order of mammals in the world. Their 925 species are found on all continents except Antarctica. Bats are in serious decline world-wide from shrinking habitat, persecution and pesticides. Historically, bats were recognized for consuming insect pests, but only recently has the critical additional importance of bats in pollination and seed dispersal of semi-tropical and tropical plants been recognized. Bats use artificial structures in place of lost natural habitat, resulting in their destruction out of fear and ignorance. The health risk to humans from bats in buildings is extremely low, but where bat removal is necessary, non-lethal exclusion methods can be very effective.

## INTRODUCTION

Bats are the second largest order (Chiroptera) of mammals in the world, and the only mammal capable of true flight (Bat Conservation International 1992). The 925 species of bats represents nearly a quarter of all the species of mammals on earth. The majority live in tropical and semi-tropical regions using a wide variety of roosts in foliage, hollow trees, rock crevices, caves, or burrows of other animals (Fenton, 1983). Of the 44 species in North America, all but four prefer cavities for hibernating and raising their young. Surprisingly, Tuttle (1988) discovered that only 5% of temperate zone caves have the right temperature ranges to be useful to bats. World-wide, bats are in decline from shrinking habitat, persecution, and pesticides. Bats use human dwellings in place of lost habitat, causing further conflicts. The recent discovery of the tremendous importance of bats in ecological systems has set off a much belated effort to reverse their decline.

## WHY DO BATS USE HUMAN DWELLINGS?

Thousands of years ago, the cavities bats preferred were abundant as hollow trees, natural rock cracks and caves (Racey, 1992). As humans began to clear the forests, first in Europe, then in North America, the hollow trees disappeared and increasingly bats moved into human dwellings to take advantage of the increase in insects provided by agriculture and domestic animals. Clearing the forests also exposed the cave entrances which people began to explore and utilize, driving more bats to find new homes. Fenton (1983) added that early Europeans lived harsh lives filled with superstition. He pointed out that these small, screeching, flying beasts, who emerged only at night from secret holes and caves, became the myths of bloodthirsty vampires, drafty, dark castles, and evil spirits. Fenton (1983) remarked that we got past the evil spirit part, but continued to consider them dirty, dangerous, common carriers of rabies, and ugly creatures that get tangled in our hair.

The 20th century has seen the most rapid decline in bat numbers in history (Tuttle, 1991). Tuttle listed three reasons for this accelerating decline: 1) increased logging in tropical and semi-tropical forests, 2) increased year-round use of caves for recreational exploring, and 3) deliberate killing from ignorance or as part of vampire bat eradication programs. Fenton (1992b) added a fourth reason: This massive increase in the use of chemical pesticides against insects (70% of bats eat insects), and against bats directly. Bats use human dwellings in summer as well as winter. Female bats seek very warm environments in which to give birth and keep their flightless young. Audet and Fenton (1987) commented that this environment might allow for mother and pup to use all available energy for lactation and growth, and waste none on keeping warm. In cooler northern climates, bat nurseries would have been in the trunks of sun-warmed trees, dry wood being an excellent insulator (Kurta, 1985). The hot summer attics of older homes, in temperate regions of the world, became roomy substitutes for missing trees. Access to dwellings was through any small crevice, plentiful in older homes, where settling opened cracks around chimneys and walls (Fenton, 1992b). Fenton found that the small *Myotis* spp. could squeeze through a crack only 5mm high. In winter, cold-tolerant species such as the big brown bat (*Eptesicus fuscus*) in North America, and *Pipstrelles* spp. in Europe, hibernated in the walls of homes where they tolerate temperatures down to $0^0$C (Ransome, 1990).

## House Bats and Human Conflict

House-using bats create three common problems that cause people to seek their removal: stains and odor, noise, and fear of disease (Fenton, 1992a). Interestingly, in radio-tracking bats all over Canada, M. Fenton (pers. commun. 1992) discovered that 80% of people who had maternity colonies in their dwellings were unaware of their presence, and that hibernating bats, who are quiet and deposit no guano, are almost never detected. He explained that nursery colonies can deposit large piles of guano under their roosting areas, creating a bad odor and staining the ceiling in the living area below. In addition, nursery colonies are quite noisy with nonstop squeaking and fluttering of moving bats.

Once people detected the bats, Tuttle and Kern (1981) reported that they became fearful of getting diseases from the animals themselves or their guano. They noted that only two diseases can result from contact with bats: rabies and histoplasmosis. Additionally, they pointed out that less than 1% of bats carry rabies, a lower rate than skunks, fox, or domestic dogs. Tuttle and Kern (1981) and Constantine (in Kunz, 1987) reported less than an a dozen human deaths from bat-strain rabies virus in North America since 1955, and that healthy bats do not attack people.

The other infection, histoplasmosis, causes a nonfatal lung infection in humans who breath in the fungal spores in dust contaminated with chicken, pigeon or bat droppings (Tuttle, 1988). It is considered an occupational hazard of chicken farmers, pigeon fanciers, bat biologists, and cave explorers in the eastern United States, but Constantine (in Kunz, 1987) found that histoplasmosis was absent in most of the dryer Western states. Additionally, M. Fenton (pers. commun.) added that histoplasmosis is not known to occur in Canada. Tuttle and Kern (1981) recommended the use of a respirator, with a 2 micronfilter, when handling any dry dung. Fenton (1988) reported that the various parasites found on bats, and in their roosts, were species-specific and did not bite humans.

## THE VALUE OF BATS

How are bats any different than the millions of other commensal animals, like mice and rats, that humans attempt to control world-wide each year? Notably, bats cause little harm to humans and, in fact, are beneficial globally. The biology and ecology of bats is unique among animals. Bats eat the widest variety of foods of any animal on earth. This diet includes insects, arachnids, fish and krill, reptiles and amphibians, rodents and other bats, birds, blood, nectar, and pollen, which has allowed them to colonize all the life zones of the world (Fenton, 1992b).

Seventy percent of the world's bats eat insects, many of which carry disease or are agricultural and timber pests, especially nocturnal moths and beetles (Whitaker, in Kunz 1987). Whitaker (1993) observed that just one bat can consume 600 mosquito-sized insects per hour, and its own body weight in insects daily. In one summer season, he recorded that 150 bats, an average maternity colony in the Midwest, could easily eat 38,000 cucumber beetles, 16,000 June bugs, 19,000 stink bugs, and 50,000 leaf hoppers, among other insects. Tuttle (1990) added that the guano under large bat colonies is a valuable source of fertilizer for rural agricultures in developing countries. Of possibly greater importance is the recent discovery that nectar and fruit-eating bats are the major pollinators and seed dispersers of hundreds of species of tropical and semi-tropical plants, many of which produce crops valued in the hundreds of millions of dollars annually in cash-poor developing countries (Bat Conservation International, 1992; Fenton, 1992b). Thomas (1991) observed that when areas of tropical rain forest are clear-cut, seeds deposited by fruit-eating bats are the first plants to recolonize these disturbed areas.

## SOCIAL BEHAVIOR AND MORTALITY

In and of themselves, bats are valuable because they are such a unique and diverse life-form. Ironically, these gentle, shy, and fascinating creatures are very vulnerable to destruction because of their highly social behavior of roosting in very large groups in trees, buildings, caves, and mines easily accessible by humans (Tuttle, 1991). Fenton (pers. commun.) observed that female colonial bat species have only one pup per year, and disturbance of the large summer nursery colonies caused females to abandon the pups. In some countries bats are shot (Rainey, 1990) or netted for food (Tuttle, 1990; Bat Conservation International, 1992). During hibernation, disturbed bats, awakened unnecessarily, waste critical calories needed to endure up to eight months of fasting, and may starve to death before spring arrives (Tuttle, 1991). Bats have been used for target practice, and have been burned and dynamited in the mistaken belief that they were vampire bats (Murphy, 1991). Murphy reported that only three species of bats in Central and South America drink blood, and one of these feeds exclusively on birds.

## WAR ON BATS

World War II saw the further acceleration of the decline of bats globally, resulting from the massive development and application of chemical pesticides (Fenton, 1992b). Fenton reported that, at first, bats died from consuming insects sprayed with DDT and sulfur. Following WW II, many more insecticides were developed and became available to the public for home use. Pest control companies sprang up to take advantage of this quick and easy way to rid homes and farms of all pests, including bats. What followed was 30 years of dosing millions of homes and buildings with a variety of pesticides, some with killing power lasting decades (Fenton, 1983; pers. commun. 1992; Tuttle, 1988; Racey, 1992).

Tuttle (1988) reported what followed. Thousands of bats sickened, left their roosts, and fell dying for miles around the area, frightening people and starting the unfounded belief that most bats were rabid. These roosts were constantly refilled with more bats seeking shelter, providing steady repeat business for exterminators. People and pets sickened and died, because the poisons affected all mammals. Tuttle (1988) went on to add that moth balls, chloroform, bright lights, and fans were tried and all failed. Bomford and O'Brien (1990) reported test results on two high-intensity ultrasonic devices designed to repel rodents and bats, and found that neither worked. Tuttle (1988) reported that ultrasonic devices, in some cases, attracted bats! Millions of dollars were wasted and countless animals and humans suffered because no chemical or electric device has ever been found to repel bats permanently.

## HUMANE SOLUTIONS TO BAT PROBLEMS

There are however, two proven options to the problem of bats in human structures. The first is called exclusion or roost sealing, and entails locating and closing all the holes the bats are using to get into buildings. The second involves educating the would-be evictors to coexist peacefully with the bats.

Fenton (1992b) described the first option as two different problems. Residents frequently encountered a bat the first time when it happened to enter a room and fly about. These stray bats were often youngsters from a nursery colony, just learning to fly. Fenton suggested the simple solution of opening a window or a door, removing the screen, turning off the light and letting it fly out. With the more confident homeowner, he suggested waiting for it to land, scooping it up in a thick towel, carrying it outside and gently shaking it out. Fenton cautioned that all bats bite in self-defense when frightened, and should always be handled wearing gloves.

The second problem addressed by both Fenton (1992b) and Tuttle (1988) dealt with the colony itself. They noted that most colonies of bats use either spaces in walls or attics which they have accessed through small openings in the building. They noted that the entry hole or holes often showed some brown staining or guano spatter marks around them, and when bats are in residence, they can be observed by flashlight leaving the hole after dark. In addition, small, crumbly brown bat droppings often accumulate on the ground under an entry hole, giving a clue to the location of hard to spot entrances. Bat researches generally recommend sealing holes in late fall, winter, or early spring, when the roost area is naturally empty. At these times, attic areas are cooler to work in and daylight showing through cracks will help the evictor locate and plug the holes with putty, foam insulation, steel wool, or tape. Bats do not chew entrance holes like rodents, and will not chew their way back in next spring (Fenton, 1992b).

If guano piles are to be removed, Tuttle (1988) recommended wearing a 2 micron mesh filter respirator. Hanks (1991), a professional bat excluder, once removed 2,268kg of guano from a 19th century building. Guano is a superb fertilizer and gardners carried it all away.

When adult bats are in the roost, Fenton (1992b), Hanks (1991), Tuttle (1988), and E. Pierson (pers. commun. 1994) described a number of simple ways to evict bats without harming them. First, locate all the holes the bats are using and seal all but three or four main exits. Second, hang some barrier material over the holes. This can be heavy plastic netting (1 $cm^2$ mesh), window screening, or opaque or clear plastic sheeting. Pierson cautioned against using fruit tree bird netting, because small bats can become tangled in its larger hole size and die. Use duct tape or staples to secure the barrier material 4 to 6 cm above the holes, extending at least 30 cm to each side, and 30 to 60 cm below. It should hang loosely so the bats will be able to crawl below the barrier to take flight. When bats return, they try to land directly at the hole which the barrier now prevents them from entering. The exit holes should be checked nightly for several nights, or over several weeks, to make sure all the bats are out of the roost before sealing the last holes and removing the barriers.

Hanks (pers. commun. 1994) has invented a simple excluder of quarter-inch hardware wire cloth, formed into a 20 cm long cylinder, approximately 8 cm in diameter. He cuts one end of the cylinder into 8 to 10 tabs, each 2 to 3 cm long, flared like flowered petals. These cylinders are placed over the exit holes and secured by the tabs. The protruding end of each cylinder is pinched into a narrow, flattened oval just wide enough for a bat to exit through. He has installed thousands of these wire cloth excluders which are left permanently in place. Under no circumstances should a roost be sealed when flightless young are present. Not only is this a cruel, unnecessary death of a valuable animal, but it could cause a serious odor problem.

## LIVING WITH BATS

Bat control, however may not be compatible with bat conservation. Brigham and Fenton (1987), radio-tracked pregnant big brown bats (Eptesicus fuscus) as they were excluded from roosts in five buildings in Canada. They discovered the females moved to the nearest other building with a suitable roost, often only 100m away. In rural areas, they reported the females often just moved to the nearest available building. Using bat detectors, they recorded 262 attempts per night to reenter the old roost, and if any new hole was found, the entire colony moved back immediately. Of concern was the fact that these researchers noted a 66% mean infant mortality rate in evicted pregnant bats, as opposed to only a 14% mean infant mortality rate for pregnant females using familiar, undisturbed roosts.

The second option requires educating the public to the enormous value of bats, and the need to protect and coexist with them. As Fenton (pers. commun.) noted previously, 80% of the people are aware of existing bat colonies in their homes, with no detrimental effects on these homeowners. He found this to be especially true if the home was well insulated. The growing interest in composting and pesticide-free gardening might be the incentive for reluctant bat-roost owners to realize quick benefits from such a colony. Removing old guano in fall or winter would stop the odor problem. The attic could then be well insulated, saving the resident heating and cooling dollars, and stopping bat noise. A heavy layer of heat-tolerant plastic, under the colony roosting site, would facilitate the yearly harvest of the rich fertilizer as a renewable resource. If the bats are evicted from the house walls, the attic or other out-buildings, could be prepared and made available for the colony. This will become a long lasting friendship as bats live up to 32 years (Fenton, 1992b). Where total bat exclusion is necessary, bat houses could be constructed in the area to provide alternate roosts and encourage the bats to stay in the area (Tuttle and Hensley, 1993). In England, as well as Europe, Racey (1992) reported a growing interest in reversing the decline of their once abundant bat populations. He reported that in Britain, a permit, plus approval of the local wildlife authorities, is required to evict bats from a building or cut down a hollow tree.

## SUMMARY

For thousands of years bats have been mislabeled as evil, dirty, and dangerous to humans. It was not until 1930 that researchers understood their echolocation. Even though they make up nearly 25% of the world’s mammals, they have been so understudied that their tremendous value as insect pest controllers is now being fully appreciated, and their role in the plant seed and pollen dispersion, was virtually unknown before 1950. As a consequence, superstition and ignorance controlled needless persecution and slaughter of these beneficial, flying animals.

Driven from their forest and cave homes, the dwindling number of bats sought refuge in remaining forest tracts and human structures, where they continued to be chemically assaulted and evicted. A massive, 11th hour public education campaign is now under way by such organizations as Bat Conservation International in the U.S., and the Bat Conservation Trust in Britain, to undo the ignorance and promote tolerance of bats. This must include protecting their critical cave and mine roosts, allowing them to share our buildings, and in fact, welcoming them by building bat houses. A better, healthier world for bats will result in a better, healthier world for humans.

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